



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/531,710

04/18/2005

Seong Ho Yoon

LNK-0108

1474

23413 7590 12/12/2007  
CANTOR COLBURN, LLP  
55 GRIFFIN ROAD SOUTH  
BLOOMFIELD, CT 06002

EXAMINER

SMITH, JENNIFER A

ART UNIT

PAPER NUMBER

4116

MAIL DATE

DELIVERY MODE

12/12/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/531,710	<b>Applicant(s)</b> YOON, SEONG HO	
	<b>Examiner</b> JENNIFER A. SMITH	<b>Art Unit</b> 4116	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 12 November 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-11 is/are pending in the application.
- 4a) Of the above claim(s) 1, 3, 5, 7, 9 and 11 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 4, 6, 8, 10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 April 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>04/18/2005</u> .  | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Status of Application***

Applicant's election without traverse to prosecute the subject matter of Group I and Species (i) – Claims 4, 6, 8, and 10 is acknowledged.

Claims 1, 3, 5, 7, 9, 11 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected subject matter, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 11/12/2007.

Claim 2 has been canceled.

Claims 4, 6, 8, and 10 are presented for examination.

### ***Priority***

Acknowledgment is made of applicant's claim for foreign priority under 35 U.S.C. 119(a)-(d). The certified copy has been filed on 04/18/2005.

### ***Information Disclosure Statement***

The information disclosure statement (IDS) was submitted on 04/18/2005. The submission is in compliance with the provisions of 37 CFR 1.97. Accordingly, the

information disclosure statement has been considered by the examiner. Please refer to applicants' copy of the 1449 submitted herewith.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 4, and 6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites the limitation "the furnace" in line 9. There is insufficient antecedent basis for this limitation in the claim.

Claim 6 recites the limitation "the hydrogen partial pressure in the mixture of hydrocarbons and hydrogen is selected between 0-80 v/v%". Partial pressure is traditionally a value with unit of pressure (atm, Pa, etc.). It is believed that applicant is reciting a volume ratio and the use of term "partial pressure" should be corrected to reflect this.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 4, 6, 8, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smalley et al. US Patent Publication 2002/0098135 A1 in view of Iyer et al. US Patent No. 7,261,871 B2.

The instant claims 4 is drawn to a method for producing fibrous carbon using a carbon black supported metal mixture of alloy catalysts.

- The metal mixture involves nickel as a major catalyst and iron or molybdenum as secondary metals.

Art Unit: 4116

- Carbon black has less than 100 m<sup>2</sup>/g surface area, a 20-60 nm particle size, and more than 10 wt% oxygen content.
- 0.1 – 60 wt% metal in relation to carbon black
- The carbon source is introduced at a flow rate of 0.5-40 sscm per 1 mg catalyst into the furnace
- The carbon source is a hydrocarbon with 2-6 carbon atoms or a mixture.

The fibrous carbon produced has the following characteristics:

- Carbon content is more than 95 wt%
- The diameters range from 3.5 to 79.9 nm
- The aspect ratio is more than 20
- The carbon hexagonal planes align perpendicular to the fiber axis
- There is no continuous hollow core within.

Smalley et al. (US '135, hereafter) teaches the production of carbon nanotube fibers and ropes. Group VI or VIII transition metals catalyze the growth of the carbon nanoropes - Paragraph [0064]. Preferably, these metals are selected from the group consisting of iron, cobalt, ruthenium, nickel, and platinum. These metals are mixed with carbon in preferable range of .1 to 10 atom% - Paragraph [0076]. US '135 teaches supplying a gaseous source of carbon and examples of sources of hydrocarbons having 1 to 7 carbon atoms - Claim 58. US '135 does not teach a flow rate but this represents an optimizable design variable which can be set by one of ordinary skill. Subsequent research explored the use of other forms of carbon included carbon black – Paragraph

[0226]. US '135 recites that carbon content of the nanofibers is preferably at least 95% - Paragraph [0095]. The fibers have diameters ranging from 0.6nm to 100nm and lengths of from 50nm to 1mm – Paragraph [0064]. These are within the ranges of diameter and aspect ratio set forth by the instant claim. The fibers can be oriented in a direction substantially perpendicular to the surface with an electric field – Paragraph [0153] and the fibers open ends can be closed by annealing [Paragraph 0106] so that there is no continuous hollow core.

The instant claim differs from US '135 because US '135 fails to teach the characteristics of the carbon source as carbon black which has less than 100 m<sup>2</sup>/g surface area, a 20-60 nm particle size, and more than 10 wt% oxygen content.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify US '332's teaching because the choice of carbon source is a design parameter and can be set by one skilled in the art. This does not cause undue experimentation because it is well known in the art that this property can be regulated/optimized. One would have been motivated to make such a modification because US '332 teaches that research of other forms of carbon such as carbon black have been shown to exhibit much larger Li capacities than graphite, an important quality for battery technology. [Paragraph 0226]

Art Unit: 4116

Claim 6 is drawn to the method of claim 4 and additionally:

- the hydrogen partial pressure in the mixture of hydrocarbons and hydrogen is selected between 0-80 v/v%
- the production temperature is between 300-499°C
- the production time is selected between 2-12 hours

US '332 teaches the feedstock concentration of hydrocarbon gas. The partial pressure is in the .001 to 1000 Torr range, preferably 1 to 10 Torr – Paragraph [0165]. This partial pressure is in the range of .2-4 v/v%. The pressure in the annealing zone should be maintained in the range of preferably 300-600 Torr - Paragraph [0069]. The production temperature in the annealing zone is preferably 400-1200°C. Furthermore the abstract of Iyer et al. teaches a similar process for the production of carbon nanotubes. Details of the process include the heating of the transition metal complex is completed at a temperature between 400-800°C and for between 0.1 to 24 hours and more particularly 0.5-3 hours in a sealed vessel under a partial pressure gaseous conditions. These design parameters are well known in the art and Iyer et al. is just one of the many references such details can be found. It is therefor obvious to use such a temperature, pressure, and process time for the production of nano-size fibrous carbon.

Claim 8 is drawn to the method of claim 6 and the carbon black-supported catalyst is treated as follows: oxidation to contain less than 1 wt % carbon black at 300-



Art Unit: 4116

500°C in oxidative gas containing about 40 v/v % oxygen or carbon dioxide in inert gases such as nitrogen, argon or helium; and repetitive reduction by 1-3 times in gas mixtures of 5-40 v/v % hydrogen in nitrogen, argon or helium at 400-500°C for 1-48 h.

US '332 teaches the purification process of the present invention (method of producing fibers) comprises heating the nanotube-containing felt (fibers) under oxidizing conditions to remove the amorphous carbon deposits and other contaminating materials in Paragraph [0096]. While US '332 does not disclose temperature, volume percent, or process times for the oxidation process, one of ordinary skill could reasonably determine these optimal conditions of these parameters without undue experimentation. Furthermore, US '332 teaches a final purity in Paragraph [0095] of up to 99%.

Claim 10 is drawn to the method of claim 8 wherein said alloy is composed of 0.1/0.9~0.95/0.05(wt/wt) of Ni/Fe; 0.05/0.95~0.95/0.05(wt/wt) of Ni/Co; and 0.1/0.9~0.9/0.1(wt/wt) of Ni/Mo.

US '332 teaches when mixtures of two or more Group VI or VIII transition metals are used, each metal should be 1 to 99 atom% of the metal mix. Both the instant claim and US '332 are drawn to broad ranges for transition metal alloy and claim 10 is therefore obvious over the prior art.

***Conclusion***

Claims 4, 6, 8, and 10 are rejected.

Claims 1, 2, 5, 7, 9, 11 are withdrawn from consideration.

Claim 2 is cancelled.

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Smith whose telephone number is 571-270-3599. The examiner can normally be reached on Monday - Friday, 8:30am to 5:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on 571-272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 10/531,710  
Art Unit: 4116

Page 10

Jennifer A. Smith  
December 5, 2007  
TC 4116

/Vickie Kim/  
Supervisory Patent Examiner, Art Unit 4116